LEVEL II SCHWESER'S QuickSheet

CRITICAL CONCEPTS FOR THE 2024 CFA® EXAM

QUANTITATIVE METHODS

MULTIPLE REGRESSION

Coefficient of Determination, R^2

$$R^2 = \frac{\text{total variation} - \text{unexplained variation}}{\text{total variation}}$$

$$= \frac{SST - SSE}{SST} = \frac{\text{explained variation}}{\text{total variation}} = \frac{RSS}{SST}$$

$$MSE = \frac{SSE}{n-k-1};\ MSR = \frac{RSS}{k};\ R^2 = \frac{RSS}{SST}$$

Adjusted R^2

$$R_a^2 = 1 - \left[\left(\frac{n-1}{n-k-1}\right) \times (1 - R^2)\right]$$

Akaike's information criterion (AIC) and Schwarz's Bayesian information criteria (BIC):

AIC is used if the goal is to have a better forecast, while BIC is used if the goal is a better goodness of fit. Lower values of each are better.

F-statistic to evaluate nested models:

$$F = \frac{(SSE_R - SSE_U) / q}{(SSE_U) / (n-k-1)}$$

with q and (n−k−1) degrees of freedom.

F-test statistic to evaluate overall model fit:

$$F = \frac{(RSS_U) / k}{(SSE_U) / (n-k-1)}$$

Model Misspecification

- Omitting a variable (that should be included).
- Variable should be transformed (for linearity).
- Inappropriate scaling of the variable.
- Incorrectly pooling data (e.g., different regimes).

Regression Analysis—Problems

- **Heteroskedasticity:** Non-constant error variance. Detect with scatter plots or Breusch–Pagan test. Correct with White-corrected standard errors.
- **Autocorrelation:** Correlation among error terms. Detect with Durbin–Watson (DW) test or Breusch–Godfrey (BG) test. Correct using robust (a.k.a. Newey–West corrected) standard errors.
- **Multicollinearity:** High correlation among Xs. (F-test significant, t-tests insignificant.) Detect using VIF. Correct by dropping correlated X variables.

Variance inflation factor (VIF) to quantify multicollinearity: $VIF_j = 1 / (1 - R_j^2)$

Cook's distance (D_i) detects influential data points:

$$D_i = \frac{e_i^2}{k \times MSE}\left[\frac{h_{ii}}{(1-h_{ii})^2}\right]$$

$D_i > \sqrt{k/n} \rightarrow$ likely an influential data point

Logistic regression (logit) models:

$$\ln\left(\frac{p}{1-p}\right) = b_0 + b_1X_1 + b_2X_2 + \ldots + \varepsilon$$

$$\text{odds} = e^{\hat{y}}$$

$$P = \text{odds} / (1 + \text{odds}) = 1 / (1 + e^{-\hat{y}})$$

Likelihood ratio (LR) test for logistic regressions: LR = −2 (log likelihood restricted model − log likelihood unrestricted model)

TIME-SERIES ANALYSIS

Linear trend model: $y_t = b_0 + b_1t + \varepsilon_t$

Log-linear trend model: $\ln(y_t) = b_0 + b_1t + \varepsilon_t$

Covariance stationary: Mean and variance stable over time. To conclude a time series is covariance stationary: (1) plot data, (2) regress an AR model and test correlations, or (3) do Dickey-Fuller test.

Unit root: Coeff on lagged dependent variable = 1. Series with unit root is not covariance stationary. First differencing will often eliminate the unit root.

Autoregressive (AR) model: Specified correctly if autocorrelation of residuals not significant.

Mean-reverting level for AR(1) $= \dfrac{b_0}{(1 - b_1)}$

RMSE: Square root of average squared error.

Random Walk Time Series

$$x_t = x_{t-1} + \varepsilon_t$$

Seasonality: Indicated by statistically significant lagged error term. Correct by adding lagged term.

ARCH: Detected by estimating:

$$\hat{\varepsilon}_t^2 = a_0 + a_1\hat{\varepsilon}_{t-1}^2 + \mu_t$$

Variance of ARCH series:

$$\hat{\sigma}_{t+1}^2 = \hat{a}_0 + \hat{a}_1\hat{\varepsilon}_t^2$$

MACHINE LEARNING

Supervised learning: Algorithm uses labeled training data to model relationships.

Unsupervised learning: Algorithm uses unlabeled data to determine the structure of the data.

Deep learning algorithms: E.g., neural networks and reinforced learning. Learn from their own prediction errors. Used in image recognition, natural language processing, etc.

BIG DATA PROJECTS

Preparing Data

Normalization: Scales values between 0 and 1.

$$\text{normalized } X_i = \frac{X_i - X_{min}}{X_{max} - X_{min}}$$

Standardization: Centered at 0; scaled as std devs.

$$\text{standardized } X_i = \frac{X_i - \mu}{\sigma}$$

Fit of a Machine Learning Algorithm

$$\text{precision (P)} = \frac{\text{true positives}}{(\text{false positives} + \text{true positives})}$$

$$\text{recall (R)} = \frac{\text{true positives}}{(\text{true positives} + \text{false negatives})}$$

$$\text{accuracy} = \frac{(\text{true positives} + \text{true negatives})}{(\text{all positives and negatives})}$$

F1 score $= (2 \times P \times R) / (P + R)$

Receiver operating characteristic (ROC): Shows tradeoff between false positives and true positives.

Root mean square error (RMSE): Used when the target variable is continuous.

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}(\text{predicted}_i - \text{actual}_i)^2}{n}}$$

ECONOMICS

CURRENCY EXCHANGE RATES

Bid-ask spread = ask quote − bid quote

Cross rates with bid-ask spreads:

$$\left(\frac{A}{C}\right)_{bid} = \left(\frac{A}{B}\right)_{bid} \times \left(\frac{B}{C}\right)_{bid}$$

$$\left(\frac{A}{C}\right)_{offer} = \left(\frac{A}{B}\right)_{offer} \times \left(\frac{B}{C}\right)_{offer}$$

Currency arbitrage: "Up the bid and down the ask."

Forward premium = (forward price) − (spot price)

Value of fwd currency contract prior to expiration:

$$V_t = \frac{(FP_t - FP)(\text{contract size})}{\left[1 + R_A\left(\frac{days}{360}\right)\right]}$$

Covered interest rate parity:

$$F = \frac{\left[1 + R_A\left(\frac{days}{360}\right)\right]S_0}{\left[1 + R_B\left(\frac{days}{360}\right)\right]}$$

Uncovered interest rate parity:

$$E(\%\Delta S)_{(A/B)} = R_A - R_B$$

Fisher relation:

$$R_{nominal} = R_{real} + E(\text{inflation})$$

International Fisher relation:

$$R_{nominal\ A} - R_{nominal\ B} = E(\text{inflation}_A) - E(\text{inflation}_B)$$

Relative purchasing power parity: High inflation rates lead to currency depreciation.

$$\%\Delta S_{(A/B)} = \text{inflation}_{(A)} - \text{inflation}_{(B)}$$

where: $\%\Delta S_{(A/B)}$ = change in spot price (A/B)

Profit on FX carry trade = interest differential – change in the spot rate of investment currency

Mundell-Fleming model: Impact of monetary and fiscal policies on interest rates & exchange rates. Under high capital mobility, expansionary monetary policy/restrictive fiscal policy → low interest rates → currency depreciation. Under low capital mobility, expansionary monetary policy/expansionary fiscal policy → current account deficits → currency depreciation.

Dornbusch overshooting model: Restrictive monetary policy → short-term appreciation of currency, then slow depreciation to PPP value.

ECONOMIC GROWTH

Cobb-Douglas production function:

$$Y = TK^{\alpha}L^{(1-\alpha)}$$

Labor productivity:

output per worker $Y/L = T(K/L)^{\alpha}$

Growth accounting:

growth rate in potential GDP
= long-term growth rate of technology
+ α (long-term growth rate of capital)
+ (1 − α) (long-term growth rate of labor)

growth rate in potential GDP
= long-term growth rate of labor force
+ long-term growth rate in labor productivity

Classical Growth Theory

- Real GDP/person reverts to subsistence level.

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Neoclassical Growth Theory
- Sustainable growth rate is a function of population growth, labor's share of income, and the rate of technological advancement.
- Growth rate in labor productivity driven only by improvement in technology.
- Assumes diminishing returns to capital.

$$g^* = \frac{\theta}{(1-\alpha)} \qquad G^* = \frac{\theta}{(1-\alpha)} + \Delta L$$

Endogenous Growth Theory
- Investment in capital can have constant returns.
- ↑ in savings rate → permanent ↑ in growth rate.
- R&D expenditures ↑ technological progress.

ECONOMICS OF REGULATION
Classifications of Regulations
- *Statutes:* Laws made by legislative bodies.
- *Administrative regulations:* Issued by government.
- *Judicial law:* Findings of the court.

Classifications of Regulators
- Can be government agencies or independent.
- Independent regulators can be SROs or SRBs. SROs are given government recognition.

Self-Regulation in Financial Markets
- SROs are more prevalent in common-law countries than in civil-law countries.

Economic Rationale for Regulatory Intervention
- *Informational frictions* arise in the presence of information asymmetry.
- *Externalities* deal with provision of public goods.
- *Weak competition* → less innovation, higher prices.
- *Social objectives* such as provision of public goods.

Regulatory Interdependencies and Their Effects
- *Regulatory capture theory:* Regulatory body is influenced or controlled by industry being regulated.
- *Regulatory arbitrage:* Exploiting regulatory differences between jurisdictions, or difference between substance and interpretation of a regulation.

Tools of Regulatory Intervention
- Price mechanisms, restricting or requiring certain activities, and provision of public goods or financing of private projects.

Financial market regulations: Seek to protect investors and to ensure stability of financial system.
Securities market regulations: Include disclosure requirements, regulations to mitigate agency conflicts, and regulations to protect small investors.
Prudential supervision: Monitoring institutions to reduce system-wide risks and protect investors.

Anticompetitive Behaviors and Antitrust Laws
- Discriminatory pricing, bundling, exclusive dealing.
- Mergers leading to excessive market share blocked.

Net regulatory burden: Costs to the regulated entities minus the private benefits of regulation.

FINANCIAL STATEMENT ANALYSIS

INTERCORPORATE INVESTMENTS
Accounting for Intercorporate Investments
Investment in financial assets: <20% owned, no significant influence.
- Amortized cost on balance sheet; interest and realized gain/loss on income statement.
- FVOCI at FMV with gains/losses in equity on B/S; dividends, interest on I/S.
- FVPL at FMV; dividends, interest, realized and unrealized gains/losses on I/S.

Investments in associates: 20%–50% owned, significant influence. With equity method, pro rata share of the investee's earnings increases B/S investment account, also in I/S. Dividends received decrease investment account (div. not in I/S).
Business combinations: >50% owned, control. Acquisition method required under U.S. GAAP and IFRS. Goodwill not amortized, subject to annual impairment test. All assets, liabilities, revenue, and expenses of subsidiary are combined with parent, excluding intercomp. trans. If <100%, minority interest account for share not owned.
Joint venture: 50% shared control. Equity method.

Financial Effect of Choice of Method
Equity, acquisition, & proportionate consolidation:
- All three methods report same net income.
- Assets, liabilities, equity, revenues, and expenses higher under acquisition vs. equity method.

IFRS AND U.S. GAAP DIFFERENCES
Fair value accounting, investment in associates:
IFRS – Only for venture capital, mutual funds, etc.
U.S. GAAP – Fair value accounting allowed for all.

Goodwill:
- IFRS permits either "partial goodwill" or "full goodwill" to value goodwill and noncontrolling interest. U.S. GAAP requires full goodwill.

Goodwill impairment processes:
IFRS – 1 step (recoverable amount vs. carrying value).
U.S. GAAP – 2 steps (identify; measure amount).

Acquisition method contingent asset recognition:
IFRS – Contingent assets are not recognized.
U.S. GAAP – Recognized; recorded at fair value.

Prior service cost:
IFRS – Recognized as an expense in P&L.
U.S. GAAP – Reported in OCI; amortized to P&L.

Actuarial gains/losses:
IFRS – Remeasurements in OCI and not amortized.
U.S. GAAP – OCI, amortized with corridor approach.

Dividend/interest income and interest expense:
IFRS – Either operating or financing cash flows.
U.S. GAAP – Must classify as operating cash flow.

EMPLOYEE COMPENSATION
Stock Grant
number of treasury shares = assumed proceeds / average share price during the reporting period.

assumed proceeds = cash proceeds + average unrecognized share-based compensation expense

Pension Accounting
- Ending PBO = beginning PBO + interest cost + current service cost + past service cost +/− actuarial losses/gains − benefits paid

Balance Sheet
- Funded status = fair value of plan assets − PBO = balance sheet asset under GAAP and IFRS.

Income Statement
- IFRS & GAAP differ on periodic pension cost in income statement.
- Under GAAP, periodic pension cost in P&L = service cost + interest cost ± amortization of actuarial (gains) and losses + amortization of past service cost − expected return on plan assets.
- Under IFRS, reported pension expense = service cost + past service cost + net interest expense.
- Under IFRS, discount rate = expected rate of return on plan assets.

U.S. GAAP interest cost = discount rate × [beginning PBO + past service cost]

IFRS net interest income (expense) = discount rate × [beginning funded status − past service cost]

MULTINATIONAL OPERATIONS
Multinational Operations: Choice of Method
For self-contained sub., functional ≠ presentation currency; use current rate method:
- Assets/liabilities at current rate.
- Common stock at historical rate.
- Income statement at average rate.
- Exposure = shareholders' equity.
- Dividends at rate when paid.

For integrated sub., functional = presentation currency, use temporal method:
- Monetary assets/liabilities at current rate.
- Nonmonetary assets/liabilities at historical rate.
- Sales, SGA at average rate.
- COGS, depreciation at historical rate.
- Exposure = monetary assets − monetary liabilities.

Net asset position & depr. foreign currency = loss.
Net liab. position & depr. foreign currency = gain.

Original Financial Statements vs. All-Current
- Pure balance sheet and income statement ratios unchanged.
- If LC depreciating (appreciating), translated mixed ratios will be larger (smaller).

Hyperinflation: GAAP vs. IFRS
Hyperinfl. = cumulative inflation > 100% over 3 yrs. GAAP: use temporal method. IFRS: 1st, restate foreign curr. st. for infl. 2nd, translate with current rates. Net purch. power gain/loss reported in income.

ANALYSIS OF FINANCIAL INSTITUTIONS
Financial institutions differ from other companies due to systemic importance and regulated status.
Basel III: Minimum levels of capital and liquidity.
CAMELS: Capital adequacy, Asset quality, Management, Earnings, Liquidity, and Sensitivity.

$$\text{liquidity coverage ratio} = \frac{\text{highly liquid assets}}{\text{expected cash outflows}}$$

$$\text{net stable funding ratio} = \frac{\text{available stable funding}}{\text{required stable funding}}$$

Insurance Company Key Ratios
Underwriting loss ratio
$$= \frac{\text{claims paid} + \Delta \text{ loss reserves}}{\text{net premium earned}}$$
Expense ratio
$$= \frac{\text{underwriting expenses incl. commissions}}{\text{net premium written}}$$
Loss and loss adjustment expense ratio
$$= \frac{\text{loss expense} + \text{loss adjustment expense}}{\text{net premiums earned}}$$
Dividends to policyholders ratio
$$= \frac{\text{dividends to policyholders}}{\text{net premiums earned}}$$
Combined ratio after dividends
= combined ratio + divs to policyholders ratio
Total investment return ratio
= total investment income / invested assets
Life and health insurers' ratios
total benefits paid / (net premiums written and deposits)
commissions + expenses / (net premiums written + deposits)

QUALITY OF FINANCIAL REPORTS
Beneish model: Detects earnings manipulation using eight variables. M-score > −1.78 (i.e., less negative) → potential earnings manipulation.

High-quality earnings are:
1. **Sustainable:** Expected to recur in future periods.
2. **Adequate:** To cover the company's cost of capital.

Earnings mean reversion: Faster for accruals-based earnings, especially if accruals are discretionary.

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Indicators of Balance Sheet Quality: Unbiased measurement; completeness; clarity of presentation.

INTEGRATION OF FSA TECHNIQUES

ROE decomposed (extended DuPont equation)

$$ROE = \underbrace{\frac{NI}{EBT}}_{\textit{Tax Burden}} \times \underbrace{\frac{EBT}{EBIT}}_{\textit{Interest Burden}} \times \underbrace{\frac{EBIT}{revenue}}_{\textit{EBIT Margin}} \times \underbrace{\frac{revenue}{average\ assets}}_{\textit{Total Asset Turnover}} \times \underbrace{\frac{average\ assets}{average\ equity}}_{\textit{Financial Leverage}}$$

Accruals Ratio (balance sheet approach)

$$\text{accruals ratio}^{BS} = \frac{(NOA_{END} - NOA_{BEG})}{(NOA_{END} + NOA_{BEG})/2}$$

Accruals Ratio (cash flow statement approach)

$$\text{accruals ratio}^{CF} = \frac{(NI - CFO - CFI)}{(NOA_{END} + NOA_{BEG})/2}$$

cash generated from operations (CGO)
= operating cash flow + cash interest + cash taxes
= EBIT + noncash charges − ↑ working capital

FINANCIAL STATEMENT MODELING

Bottom-up analysis: Starts with study of an individual company or reportable segments.

Top-down analysis: Begins with expectations about the expected growth rate of nominal GDP.

Economies of scale: As production volume increases, costs fall and operating margins rise.

Porter's Five Forces Analysis

- Firms have less pricing power when the **threat of substitute products** is high & switching costs low.
- Companies have less pricing power when the **intensity of industry rivalry** is high.
- Company prospects for earnings growth are lower when the **bargaining power of suppliers** is high.
- Companies have less pricing power when the **bargaining power of customers** is high.
- Firms have more pricing power (and earnings growth) when the **threat of new entrants** is low.

Cannibalization factor: *Percentage of a new product's sales stolen* from an existing product's sales.

Sales-based pro forma company model:

1. Estimate revenue growth and future revenue.
2. Estimate COGS.
3. Estimate SG&A.
4. Estimate financing costs.
5. Estimate income tax expense and cash taxes.
6. Model the balance sheet based on income statement items and working capital estimates.
7. Use historical depreciation and capital expenditures to forecast capital expenditures and net PP&E.
8. Use the pro forma income statement and balance sheet to construct a pro forma cash flow statement.

RATIOS USED IN FINANCIAL ANALYSIS

$$\text{current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

$$\text{cash ratio} = \frac{\text{cash + marketable securities}}{\text{current liabilities}}$$

$$\text{defensive interval} = \frac{\text{cash + mkt. sec. + receivables}}{\text{daily cash expenditures}}$$

$$\text{receivables turnover} = \frac{\text{annual sales}}{\text{average receivables}}$$

$$\text{inventory turnover} = \frac{\text{cost of goods sold}}{\text{average inventory}}$$

$$\text{days of sales outstanding} = \frac{365}{\text{receivables turnover}}$$

$$\text{days of inventory on hand} = \frac{365}{\text{inventory turnover}}$$

$$\text{number of days of payables} = \frac{365}{\text{payables turnover ratio}}$$

$$\text{total asset turnover} = \frac{\text{revenue}}{\text{average total assets}}$$

$$\text{fixed asset turnover} = \frac{\text{revenue}}{\text{average fixed assets}}$$

$$\text{gross profit margin} = \frac{\text{gross profit}}{\text{revenue}}$$

$$\text{operating profit margin} = \frac{\text{operating profit}}{\text{revenue}} = \frac{\text{EBIT}}{\text{net sales}}$$

$$\text{net profit margin} = \frac{\text{net income}}{\text{revenue}}$$

$$\text{debt-to-equity ratio} = \frac{\text{total debt}}{\text{total equity}}$$

$$\text{interest coverage} = \frac{\text{EBIT}}{\text{interest}}$$

CORPORATE ISSUERS

DIVIDENDS AND SHARE REPURCHASES

Effective tax rate = corporate tax rate + (1 − corporate tax rate)(individual tax rate)

Target Payout Adjustment Model

expected increase in dividends =

$$\left[\left(\text{expected earnings} \times \text{target payout ratio}\right) - \text{previous dividend}\right] \times \text{adjustment factor}$$

adjustment factor = 1 / years of adjustment

Dividend Coverage Ratios

dividend coverage = net income / dividends

FCFE coverage ratio
= FCFE / (dividends + share repurchases)

Share Repurchases

- Share repurchase is equivalent to cash dividend, assuming equal tax treatment.
- Unexpected share repurchase is good news. Rationale: (1) tax advantages, (2) share price support, (3) increase flexibility, (4) offsetting dilution by stock options, and (5) ↑ leverage.

ESG CONSIDERATIONS

Board of directors can be structured either as a single-tier board of internal (executive) and external (non-executive) directors, or a two-tiered board (management board is overseen by a supervisory board).

CEO duality: CEO is also chairperson of the board.

ESG-related risk exposures: In fixed-income analysis, ESG considerations are primarily concerned with downside risk. In equity analysis, both upside opportunities and downside risk are considered.

COST OF CAPITAL: ADVANCED TOPICS

Grinold-Kroner model:

$$ERP = [DY + \Delta P/E + i + G - \Delta S] - r_f$$

Cost of equity based on DDM: cost of equity (r_e) = dividend yield (DY) + capital gains yield (CGY)

Fama-French model: required return of stock $= r_f + \beta_1\,ERP + \beta_2\,SMB + \beta_3\,HML$

Five-factor Fama-French extended model: required return of stock $= r_f + \beta_1\,ERP + \beta_2\,SMB + \beta_3\,HML + \beta_4\,RMW + \beta_5\,CMA$

Expanded CAPM: required return $= r_f + \beta_{peer} \times ERP + SP + IP + SCRP$

Build-up approach: required return $= r_f + ERP + SP + SCRP$

CORPORATE RESTRUCTURING

Actions can include **investment** (to increase the size and scope), **divestment** (to decrease size or scope), or **restructuring** (to improve performance).

Investment actions include equity investments, joint ventures, and acquisitions to pursue growth, synergies, or undervalued targets.

Divestment actions, including sales and spin-offs, are made to increase growth or profitability or reduce risk.

Restructuring actions: Cost cutting, balance sheet restructurings, reorganizations. To improve ROIC.

Materiality is defined by both size and fit. **Large actions** are greater than 10% of EV. **Fit** refers to the alignment between the action and expectations.

Valuation methods for corporate restructurings include **comparable company**, **comparable transaction**, and **premium paid** analysis.

EQUITY

EQUITY VALUATION

Porter's Five Forces of Industry Structure

- Rivalry (intra-industry)
- Threat of new entrants
- Threat of substitutes
- Bargaining power of suppliers
- Bargaining power of buyers

DISCOUNTED DIVIDEND VALUATION

Discounted Cash Flow (DCF) Methods

Use dividend discount models (DDM) when:

- Firm has dividend history.
- Dividend policy is related to earnings.
- Minority shareholder perspective.

Use free cash flow (FCF) models when:

- Firm lacks stable dividend policy.
- Dividend policy not related to earnings.
- FCF is related to profitability.
- Controlling shareholder perspective.

Use residual income (RI) when:

- Firm lacks dividend history.
- Expected FCF is negative.

Gordon Growth Model (GGM)

Assumes perpetual dividend growth rate:

$$V_0 = \frac{D_0(1+g)}{r-g} = \frac{D_1}{r-g}$$

Most appropriate for mature, stable firms.
Limitations are:

- Very sensitive to estimates of *r* and *g*.
- Difficult with non-dividend stocks.
- Difficult with unpredictable growth patterns (use multi-stage model).

Present Value of Growth Opportunities

$$V_0 = \frac{E_1}{r} + PVGO$$

H-Model

$$V_0 = \frac{[D_0 \times (1+g_L)]}{r-g_L} + \frac{[D_0 \times H \times (g_S - g_L)]}{r-g_L}$$

where: H = half-life (in years) of high-growth period

Sustainable growth rate: b × ROE.

Required Return From Gordon Growth Model

$$r = (D_1 / P_0) + g$$

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FREE CASH FLOW VALUATION

Free Cash Flow to Firm (FCFF)

Assuming depreciation is the only NCC:

- FCFF = NI + Dep + [Int × (1 − tax rate)] − FCInv − WCInv.
- FCFF = [EBIT × (1 − tax rate)] + Dep − FCInv − WCInv.
- FCFF = [EBITDA × (1 − tax rate)] + (Dep × tax rate) − FCInv − WCInv.
- FCFF = CFO + [Int × (1 − tax rate)] − FCInv.

Free Cash Flow to Equity (FCFE)

- FCFE = FCFF − [Int × (1 − tax rate)] + Net borrowing.
- FCFE = NI + Dep − FCInv − WCInv + Net borrowing.
- FCFE = NI − [(1 − DR) × (FCInv − Dep)] − [(1 − DR) × WCInv]. (*Used to forecast.*)

Weighted average cost of capital:
$WACC = (w_e \times r) + [w_d \times r_d \times (1 - \text{tax rate})]$

Single-Stage FCFF/FCFE Models

- **Value of the firm** $= V_0 = \dfrac{FCFF_1}{WACC - g}$
- **Value of equity** $= V_0 = \dfrac{FCFE_1}{r - g}$

2-Stage FCFF/FCFE Models

Step 1: Calculate FCF in high-growth period.
Step 2: Use single-stage FCF model for terminal value at end of high-growth period.
Step 3: Discount interim FCF and terminal value to time zero to find stock value; use WACC for FCFF, *r* for FCFE.

PRICE AND EV MULTIPLES

Price-to-Earnings (P/E) Ratio

Problems with P/E:

- If earnings < 0, P/E meaningless.
- Volatile, transitory portion of earnings makes interpretation difficult.
- Management discretion over accounting choices affects reported earnings.

Justified P/E

$$\text{justified leading P/E} = \frac{P_0}{E_1} = \frac{1 - b}{r - g}$$

$$\text{justified trailing P/E} = \frac{P_0}{E_0} = \frac{(1 - b)(1 + g)}{r - g}$$

Justified Dividend Yield

$$\frac{D_0}{P_0} = \frac{r - g}{1 + g}$$

Normalization Methods

- Historical average EPS.
- Average ROE.

PEG ratio: P/E multiple to earnings growth:

$$\text{PEG ratio} = \frac{P/E}{g}$$

Price-to-Book (P/B) Ratio

Advantages:

- BV almost always > 0.
- BV more stable than EPS.
- Measures NAV of financial institutions.

Disadvantages:

- Size differences cause misleading comparisons.
- Influenced by accounting choices.
- BV ≠ MV due to inflation/technology.

$$\text{justified P/B} = \frac{ROE - g}{r - g}$$

Price-to-Sales (P/S) Ratio

Advantages:

- Meaningful even for distressed firms.
- Sales revenue not easily manipulated.
- Not as volatile as P/E ratios.
- Useful for mature, cyclical, and start-up firms.

Disadvantages:

- High sales ≠ imply high profits and cash flows.
- Does not capture cost structure differences.
- Revenue recognition practices still distort sales.

$$\text{justified P/S} = \frac{(E_0/S_0) \times (1 - b)(1 + g)}{r - g}$$

DuPont Model

$$ROE = \left[\frac{\text{net income}}{\text{sales}}\right] \times \left[\frac{\text{sales}}{\text{total assets}}\right] \times \left[\frac{\text{total assets}}{\text{equity}}\right]$$

Price-to-Cash Flow Ratios

Advantages:

- Cash flow harder to manipulate than EPS.
- More stable than P/E.
- Mitigates earnings quality concerns.

Disadvantages:

- Difficult to estimate true CFO.
- FCFE better but more volatile.

Justified P/CF $= \dfrac{FCFE_0 \times (1 + g)}{r - g}$

Method of Comparables

- Firm multiple > benchmark implies overvalued.
- Firm multiple < benchmark implies undervalued.
- Fundamentals that affect multiple should be similar between firm and benchmark.

RESIDUAL INCOME VALUATION

Residual Income Models

- $RI = E_t - (r \times B_{t-1}) = (ROE - r) \times B_{t-1}$
- Single-stage RI model:
  $$V_0 = B_0 + \left[\frac{(ROE - r) \times B_0}{r - g}\right]$$
- Multistage RI valuation: $V_0 = B_0$ + (PV of interim high-growth RI) + (PV of continuing RI)

Economic Value Added®

- EVA = NOPAT − $WACC

$NOPAT = EBIT \times (1 - t)$
$= (\text{sales} - COGS - SGA - \text{dep}) \times (1 - t)$

PRIVATE COMPANY VALUATION

Private Equity Valuation

$$DLOC = 1 - \left[\frac{1}{1 + \text{control premium}}\right]$$

Total discount = 1 − [(1 − DLOC)(1 − DLOM)].

The DLOM varies with the following:

- An impending IPO or firm sale ↓ DLOM.
- The payment of dividends ↓ DLOM.
- Earlier, higher payments ↓ DLOM.
- Restrictions on selling stock ↑ DLOM.
- A greater pool of buyers ↓ DLOM.
- Greater risk and value uncertainty ↑ DLOM.

FIXED INCOME

TERM STRUCTURE OF INTEREST RATES

Price of a T-period zero-coupon bond:

$$P_T = \frac{1}{(1 + S_T)^T}$$

Forward price of zero-coupon bond:

$$F_{(j,k)} = \frac{1}{[1 + f(j,k)]^k}$$

Forward pricing model:

$$P_{(j+k)} = P_j F_{(j,k)} \qquad F_{(j,k)} = \frac{P_{(j+k)}}{P_j}$$

Forward rate model:

$$[1 + f(j,k)]^k = [1 + S_{(j+k)}]^{(j+k)} / (1 + S_j)^j$$

"Rolling down the yield curve": Buying bonds with maturity longer than investment horizon. Outperforms when yield curve is upward-sloping.

Swap spread$_t$ = swap rate$_t$ − treasury yield$_t$

Z-spread: When added to yield curve, makes PV of a bond's cash flows = bond's market price.

TED spread:
= (3-month MRR rate) − (3-month T-bill rate)

MRR-OIS spread:
= MRR rate − "overnight indexed swap" rate

Term Structure of Interest Rates

Traditional theories:

- Unbiased (pure) expectations theory.
- Local expectations theory.
- Liquidity preference theory.
- Segmented markets theory.
- Preferred habitat theory.

Portfolio value vs. changes in the yield curve:

$$\Delta P/P \approx -D_L \Delta x_L - D_S \Delta x_S - D_C \Delta x_C$$
(L = *level*, S = *steepness*, C = *curvature*)

Yield volatility: *Long-term* ← uncertainty regarding the real economy and inflation.
Short term ← uncertainty re: monetary policy.
Long-term yield volatility is generally lower than volatility in short-term yields.

ARBITRAGE-FREE VALUATION

Modern term structure models:

- Cox-Ingersoll-Ross: $dr = a(b - r)dt + \sigma\sqrt{r}\,dz$
- Vasicek model: $dr = a(b - r)dt + \sigma dz$
- Ho-Lee model: $dr_t = \theta_t dt + \sigma dz_t$
- Kalotay-Williams-Fabozzi (KWF) model: $d\ln(r_t) = \theta_t dt + \sigma dz_t$

BONDS WITH EMBEDDED OPTIONS

Value of option embedded in a bond:

$V_{call} = V_{straight\ bond} - V_{callable\ bond}$
$V_{put} = V_{putable\ bond} - V_{straight\ bond}$

When interest rate volatility increases:

$V_{call\ option}$↑, $V_{put\ option}$↑, $V_{callable\ bond}$↓, $V_{putable\ bond}$↑

Upward-sloping yield curve: Results in lower call value and higher put value.

When binomial tree assumed volatility *increases*:

- Computed OAS of a *callable* bond *decreases*.
- Computed OAS of a *putable* bond *increases*.

$$\text{effective duration} = \frac{BV_{-\Delta y} - BV_{+\Delta y}}{2 \times BV_0 \times \Delta y}$$

$$\text{effective convexity} = \frac{BV_{-\Delta y} + BV_{+\Delta y} - (2 \times BV_0)}{BV_0 \times \Delta y^2}$$

Effective duration:

- ED (callable bond) ≤ ED (straight bond).
- ED (putable bond) ≤ ED (straight bond).
- ED (zero-coupon) ≈ maturity of the bond.
- ED fixed-rate bond < maturity of the bond.
- ED of floater ≈ time (years) to next reset.

One-sided durations: Callables have lower down-duration; putables have lower up-duration.

Value of a capped floater
= straight floater value − embedded cap value

Value of a floored floater
= straight floater value + embedded floor value

Minimum value of convertible bond
= *greater of* conversion value or straight value

Conversion value of convertible bond
= market price of stock × conversion ratio

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fixed income continued...

Market conversion price
$= \dfrac{\text{market price of convertible bond}}{\text{conversion ratio}}$

Market conversion premium per share
= market conversion price − stock's market price

Market conversion premium ratio
$= \dfrac{\text{market conversion premium per share}}{\text{market price of common stock}}$

Premium over straight value
$= \left(\dfrac{\text{market price of convertible bond}}{\text{straight value}}\right) - 1$

Callable and putable convertible bond value
= straight value of bond
+ value of call option on stock
− value of call option on bond
+ value of put option on bond

CREDIT ANALYSIS MODELS

Expected exposure: Amount a risky bond investor stands to lose before any recovery is factored in.

Loss given default = loss severity × exposure

Probability of default: Likelihood in a given year.

Credit valuation adjustment (CVA): Sum of the present values of expected losses for each period.

Credit score/rating: Ordinal rank; higher = better.

Return from bond credit rating migration:
$\Delta\%P = -(\text{modified duration}) \times (\Delta \text{ spread})$

Structural models of corporate credit risk:
- value of risky debt = value of risk-free debt − value of put option on the company's assets
- equity ≈ European call on company assets

Reduced-form models: Do not explain why default occurs, but statistically model when default occurs.

Credit spread on a risky bond
= YTM of risky bond − YTM of benchmark

CREDIT DEFAULT SWAPS

Credit default swap (CDS): Upon credit event, protection buyer compensated by protection seller.

Index CDS: Multiple borrowers, equally weighted.

Default: Occurrence of a credit event.

Common credit events in CDS agreements: Bankruptcy, failure to pay, restructuring.

CDS spread: Higher for a *higher* probability of default and for a *higher* loss given default.

Hazard rate = conditional probability of default.

Expected loss = prob. default × loss given default.

Upfront CDS payment (by protection buyer)
= PV(protection leg) − PV(premium leg)
≈ (CDS spread − CDS coupon) × duration × NP

Change in CDS value = protection buyer's profit
≈ Δ in spread × duration × notional principal

DERIVATIVES

FORWARD COMMITMENTS

Forward contract price (cost-of-carry model):

$FP = S_0 \times (1 + R_f)^T \qquad S_0 = \dfrac{FP}{(1 + R_f)^T}$

Price of equity forward with discrete dividends:

FP(on an equity security) $= (S_0 - PVD) \times (1 + R_f)^T$

Value of forward on dividend-paying stock:

V_t(long position)
$= [S_t - PVD_t] - \left[\dfrac{FP}{(1 + R_f)^{(T-t)}}\right]$

Forward on equity index w/ continuous dividend:

$FP = S_0 \times e^{(R_f^c - \delta^c) \times T} = (S_0 \times e^{-\delta^c \times T}) \times e^{R_f^c \times T}$

where: δ^c = continuously compounded dividend yield

Forward price on a coupon-paying bond:

$FP = (S_0 - PVC) \times (1 + R_f)^T$
$= S_0 \times (1 + R_f)^T - FVC$

Value of a forward on a coupon-paying bond:

$V_t(\text{long}) = [S_t - PVC_t] - \left[\dfrac{FP}{(1 + R_f)^{(T-t)}}\right]$

Price of a bond futures contract:

$FP = [(\text{full price})(1 + R_f)^T - AI_T - FVC]$
full price = quoted spot price + AI_0

Quoted bond futures price:

QFP = forward price/conversion factor
$= [(\text{full price})(1+R_f)^T - AI_T - FVC]\left(\dfrac{1}{CF}\right)$

Forward rate agreement: "Price" of a 2 × 3 FRA is the implied 30-day forward rate in 60 days.

Swap fixed rate: SFR(periodic)

$= \dfrac{1 - Z_3}{Z_1 + Z_2 + Z_3} = \dfrac{1 - \text{final discount factor}}{\text{sum of discount factors}}$

where: $Z_n = 1/(1+R_n)$ = price of zero-coupon \$1 bond

Value of interest rate swap to fixed payer

$= \Sigma Z \times (SFR_{New} - SFR_{Old}) \times \dfrac{\text{days}}{360} \times \text{notional}$

VALUING CONTINGENT CLAIMS

Binomial stock tree probabilities:

$\pi_U = \text{probability of "up" move} = \dfrac{1 + R_f - D}{U - D}$

$\pi_D = \text{probability of "down" move} = (1 - \pi_U)$

Put-call parity: $S_0 + P_0 = C_0 + PV(X)$

synthetic call = put + stock − riskless bond
synthetic put = call − stock + riskless bond

Put-call parity when the stock pays dividends:

$P_0 + S_0 e^{-\delta T} = C_0 + e^{-rT} X$

Dynamic delta hedging:

$\#\text{ of short call options} = \dfrac{\#\text{ shares hedged}}{\text{delta of call option}}$

$\#\text{ of long put options} = -\dfrac{\#\text{ shares hedged}}{\text{delta of put option}}$

Change in option value:
$\Delta C \approx (\text{call delta} \times \Delta S) + (½ \text{ gamma} \times \Delta S^2)$
$\Delta P \approx (\text{put delta} \times \Delta S) + (½ \text{ gamma} \times \Delta S^2)$

Option value using arbitrage-free pricing:

$C_0 = hS_0 + \dfrac{(-hS^+ + C^+)}{(1 + R_f)} = hS_0 + \dfrac{(-hS^- + C^-)}{(1 + R_f)}$

$P_0 = hS_0 + \dfrac{(-hS^- + P^-)}{(1 + R_f)} = hS_0 + \dfrac{(-hS^+ + P^+)}{(1 + R_f)}$

Hedge ratio:

Calls: $h = \dfrac{C^+ - C^-}{S^+ - S^-}$ Puts: $h = \dfrac{P^+ - P^-}{S^+ - S^-}$

Black–Scholes–Merton option valuation model:
$C_0 = S_0 e^{-\delta T} N(d_1) - e^{-rT} X N(d_2)$
$P_0 = e^{-rT} X N(-d_2) - S_0 e^{-\delta T} N(-d_1)$

where:
δ = continuously compounded dividend yield
$S_0 e^{-\delta T}$ = stock price, less PV of dividends

ALTERNATIVE INVESTMENTS

COMMODITIES AND DERIVATIVES

Contango: futures prices > spot prices
Backwardation: futures prices < spot prices

Term Structure of Commodity Futures
1. **Insurance theory:** Contract buyers compensated for providing protection to commodity producers. Implies backwardation is normal.
2. **Hedging pressure hypothesis:** Like insurance theory, but includes both long hedgers (→ contango) and short hedgers (→ backwardation).
3. **Theory of storage:** Spot and futures prices related via storage costs and convenience yield.

Total return on fully collateralized long futures
= collateral return + price return + roll return

Roll return: Positive in backwardation: long-dated contracts are cheaper than expiring contracts.

$\text{roll return} = \dfrac{\left(\begin{array}{c}\text{price of expiring}\\ \text{futures contract}\end{array}\right) - \left(\begin{array}{c}\text{price of new}\\ \text{futures contract}\end{array}\right)}{\text{price of expiring futures contract}}$

REAL ESTATE INVESTMENTS

NCREIF Property Index (NPI): return
= NOI − capital exp + (end mkt val − beg mkt val)

NAV approach to REIT share valuation:
estimated cash NOI
÷ assumed cap rate
= estimated value of operating real estate
+ cash & accounts receivable
− debt and other liabilities
= net asset value
÷ shares outstanding
= NAV/share

Price-to-FFO approach to REIT share valuation:
funds from operations (FFO)
÷ shares outstanding
= FFO/share
× sector average P/FFO multiple
= NAV/share

Price-to-AFFO approach to REIT share valuation:
funds from operations (FFO)
− non-cash rents
− recurring maintenance-type capital expenditures
= AFFO
÷ shares outstanding
= AFFO/share
× property subsector average P/AFFO multiple
= NAV/share

Discounted cash flow REIT share valuation:
value of a REIT share
= PV(dividends for years 1 through n)
+ PV(terminal value at the end of year n)

HEDGE FUND STRATEGIES

Long/short equity: Stock picking; seeks alpha like a long-only approach, with lower standard deviation.

Dedicated short-selling: 60%–120% short at all times.

Short-biased strategies: 30%–60% net short, vs. long.

Equity market-neutral (EMN): Profits from short-term stock mispricing (w/leverage). Beta risk is low.

Merger arbitrage: Bets on a corporate takeover succeeding. High Sharpe ratio, with left-tail risk.

Distressed securities: Seeks mispriced securities. Long biased, high illiquidity, low leverage, and high returns.

Fixed-income arbitrage: E.g., yield curve and carry trades. Seeks out mispriced bonds. Uses high leverage.

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Convertible arbitrage: Extracts "underpriced" implied volatility. E.g., 300% long, 200% short.

Opportunistic hedge fund strategies: Tend to be highly liquid and use high leverage.

Global macro: Exploits trends in global markets.

Managed futures: Contracts actively managed for diversification. Right skew in market turmoil.

Specialist strategies: Generate uncorrelated returns in market niches. Requires specialized knowledge.

Volatility traders: Exploit Δs in vol term structure.

Life settlements: Buy policies w/ low surrender value, low premiums, insured likely to die soon.

Multi-manager hedge fund strategies: Use strategy diversification to produce low-volatility, steady returns.

Funds-of-funds: Can lack transparency, have slow tactical execution, and expose investor to netting risk.

Multi-strategy funds: Diverse strategies under one roof. Better fee structure & tactical allocation vs. FoF.

Conditional linear factor models: Four-factor model: Equity risk, currency risk, volatility risk, and credit risk.

Impact of a portfolio allocation to hedge funds:
↓ std dev, ↑ Sharpe and Sortino, and ↓ max drawdown

PORTFOLIO MANAGEMENT

EXCHANGE-TRADED FUNDS

Creation/redemption of ETFs: Authorized participants (APs) create additional shares by delivering the creation basket to the ETF manager. Redemption is by tendering ETF shares and receiving a redemption basket.

ETF spreads: Positively related to cost of creation/redemption, spread on underlying securities, risk premium for carrying trades until close of trade, and AP's normal profit margin. Negatively related to probability of completing an offsetting trade.

ETF premium (discount) %
= (ETF price − NAV per share) / NAV per share

USING MULTIFACTOR MODELS

Arbitrage Pricing Theory

$$E(R_p) = R_f + \beta_{p1}(\lambda_1) + \beta_{p2}(\lambda_2) + \ldots + \beta_{pk}(\lambda_k)$$

Expected return = risk-free rate
+ Σ(factor sensitivity) × (factor risk premium)

Multifactor model return attribution:

$$\text{factor return} = \sum_{i=1}^{k} (\beta_{pi} - \beta_{bi}) \times (\lambda_i)$$

Active return
= factor return + security selection return

Active risk squared
= active factor risk + active specific risk

$$\text{Active specific risk} = \sum_{i=1}^{n} (w_{pi} - w_{bi})^2 \sigma_{\varepsilon i}^{\,2}$$

MEASURING & MANAGING MARKET RISK

Value at risk (VaR): Estimate of minimum loss with a given probability over a specified period, expressed as $ amount or % of portfolio value.

5% annual $VaR = (mean annual return − 1.65 × annual standard deviation) × portfolio value

Conditional VaR (CVaR): The expected loss given that the loss exceeds the VaR.

Incremental VaR (IVaR): The change in VaR from a specific change in the size of a portfolio position.

Marginal VaR (MVaR): Change in VaR for a small change in a portfolio position. Used as an estimate of the position's contribution to overall VaR.

Variance for W_A% fund A + W_B% fund B

$$\sigma^2_{\text{Portfolio}} = W_A^2\sigma_A^2 + W_B^2\sigma_B^2 + 2W_AW_B\text{Cov}_{AB}$$

Annualized standard deviation

$$= \sqrt{250} \times (\text{daily standard deviation})$$

% change in value vs. change in YTM

$$= -\text{duration}\,(\Delta Y) + \tfrac{1}{2}\,\text{convexity}\,(\Delta Y)^2$$

for Macaulay duration, replace ΔY by ΔY / (1+Y)

BACKTESTING & SIMULATION

Problems in a backtest of an investment strategy:

- **Survivorship bias:** Using data that only includes entities that have persisted until today.
- **Look-ahead bias:** Using information that was unavailable at the time of the investment decision.
- **Data snooping:** Model is chosen by backtesting performance (i.e. large t-stat or small p-value).

Cross-validation: Model is first fitted using training data, then assessed using separate testing data.

Scenario analysis: Investigates a strategy's performance and risk under different structural regimes (e.g., high volatility vs. low volatility).

Stress testing: Examines performance under the worst combinations of events and scenarios.

Historical simulation: Observations are randomly chosen from the historical dataset.

Monte Carlo simulation: Statistical distribution is specified and calibrated using historical return data.

Bootstrapping: Samples drawn *with* replacement. Useful when # of simulations >> the size of dataset.

Sensitivity analysis: Overcomes the shortcomings of a traditional Monte Carlo simulation by taking into account fat tails and negative skewness.

ECONOMICS & INVESTMENT MARKETS

$$\text{Inter-temporal rate of substitution} = m_t = \frac{u_t}{u_0}$$

$$= \frac{\text{marginal utility of consuming 1 unit in the future}}{\text{marginal utility of current consumption of 1 unit}}$$

Real risk-free rate of return

$$= R = \frac{1 - P_0}{P_0} = \left[\frac{1}{E(m_t)}\right] - 1$$

Default-free, inflation-indexed, zero coupon:

$$\text{bond price} = P_0 = \frac{E(P_1)}{(1+R)} + \text{cov}(P_1, m_1)$$

Nominal short-term interest rate (r)
= real risk-free rate (R) + expected inflation (π)

Nominal long-term interest rate = R + π + θ
where θ = risk premium for inflation uncertainty

Taylor rule: $r = R_n + \pi + 0.5(\pi - \pi^*) + 0.5(y - y^*)$
where: π^* = central bank's target inflation rate
y^* = log of central bank's target (sustainable) output

Break-even inflation rate (BEI)

$$= \text{yield}_{\text{non-inflation indexed bond}} - \text{yield}_{\text{inflation indexed bond}}$$

BEI for longer maturity bonds
= expected inflation (π) + infl. risk premium (θ)

Credit risky bonds required return = R + π + θ + γ
where γ = risk premium (spread) for credit risk

Discount rate for equity = R + π + θ + γ + κ
λ = equity risk premium = γ + κ
κ = risk premium for equity vs. risky debt

Discount rate for commercial real estate
= R + π + θ + γ + κ + φ
κ = terminal value risk, φ = illiquidity premium

ACTIVE PORTFOLIO MANAGEMENT

Active return = portfolio return - benchmark return

$$R_A = R_P - R_B$$

$$\text{Portfolio return} = R_P = \sum_{i=1}^{n} w_{P,i} R_i$$

$$\text{Benchmark return} = R_B = \sum_{i=1}^{n} w_{B,i} R_i$$

Information ratio

$$= \frac{R_P - R_B}{\sigma_{(R_P - R_B)}} = \frac{R_A}{\sigma_A} = \frac{\text{active return}}{\text{active risk}}$$

$$\text{Portfolio Sharpe ratio} = SR_P = \frac{R_P - R_F}{STD(R_P)}$$

Optimal level of active risk:

$$\text{Sharpe ratio} = \sqrt{SR_B^2 + IR_P^2}$$

$$\text{total portfolio risk: } \sigma_P^2 = \sigma_B^2 + \sigma_A^2$$

Information ratio: $IR = TC \times IC \times \sqrt{BR}$

Expected active return: $E(R_A) = IR \times \sigma_A$

"Full" fundamental law of active management:

$$E(R_A) = (TC)(IC)\sqrt{BR}\,\sigma_A$$

Sharpe-ratio-maximizing aggressiveness level:

$$\sigma_A^* = \frac{IR}{SR_B}\sigma_B$$

ETHICAL AND PROFESSIONAL STANDARDS

I		**Professionalism**
I	(A)	Knowledge of the Law
I	(B)	Independence and Objectivity
I	(C)	Misrepresentation
I	(D)	Misconduct
II		**Integrity of Capital Markets**
II	(A)	Material Nonpublic Information
II	(B)	Market Manipulation
III		**Duties to Clients**
III	(A)	Loyalty, Prudence, and Care
III	(B)	Fair Dealing
III	(C)	Suitability
III	(D)	Performance Presentation
III	(E)	Preservation of Confidentiality
IV		**Duties to Employers**
IV	(A)	Loyalty
IV	(B)	Additional Compensation Arrangements
IV	(C)	Responsibilities of Supervisors
V		**Investment Analysis, Recommendations, and Action**
V	(A)	Diligence and Reasonable Basis
V	(B)	Communication with Clients and Prospective Clients
V	(C)	Record Retention
VI		**Conflicts of Interest**
VI	(A)	Disclosure of Conflicts
VI	(B)	Priority of Transactions
VI	(C)	Referral Fees
VII		**Responsibilities as a CFA Institute Member or CFA Candidate**
VII	(A)	Conduct as Participants in CFA Institute Programs
VII	(B)	Reference to CFA Institute, the CFA Designation, and the CFA Program

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